

Central Waste Water Treatment Plant Capacity Improvements & CSO Reduction – A&E

Scope of Work

MWS Project Number: 14-SC-0153

RFQ: 711080

July 30, 2015

BACKGROUND

Metro Water Services (MWS), in order to comply with the terms of the Consent Decree between MWS, the United States, and the State of Tennessee, developed the Clean Water Nashville Overflow Abatement Program (CWNOAP) to construct infrastructure improvement projects that reduce overflows from both the separate and combined sewer systems and enhance the water quality in the Cumberland River and its tributaries. The largest combined sewer overflow (CSO) in the MWS system is the Kerrigan CSO. The Central Wastewater Treatment Plant (CWWTP) Capacity Improvements and CSO Reduction project (CWWTP Improvements Project) will reduce the overflow frequency and volume from the Kerrigan CSO by increasing both the wet weather treatment capacity of the CWWTP and the overall capacity of the Central Pumping Station. The project will also add on-site CSO storage and equalization to assist in managing the dramatic flow rate increases from the combined sewer system during intense rainfall events. A key goal of this project is to provide flow attenuation for the CSO system. This will give flexibility to the operations staff as flows increase to facilitate bringing process units on line, specifically the South Grit Facility.

The CWWTP was placed into service in 1958. It has been expanded several times to increase both hydraulic and treatment capacity and to enhance residual treatment capability. The existing CWWTP has an average rated capacity of 125 million gallons per day (MGD) with a peak secondary treatment capacity of 250 MGD. Full primary treatment of an additional 80 MGD from the combined sewer system is provided by a supplemental treatment train called the Excess Flow Treatment Unit (EFTU). Including the EFTU, the CWWTP has a total existing peak primary treatment capacity of 330 MGD.

In order to increase the ability of the CWWTP to manage peak wet weather flows without constructing additional primary or secondary aeration tanks and secondary clarifiers, MWS commissioned the Central Wastewater Treatment Plant Optimization Study (Optimization Study). The Optimization Study identified limiting factors in the CWWTP's unit processes and confirmed that peak wet weather secondary treatment capacity could be increased through upgrades to the existing headworks, secondary aeration, and final clarification systems without building new tankage.

SUMMARY OF THE SCOPE OF WORK

This project scope includes the development of planning documents for the CWWTP Improvements Project. In addition, it provides the framework for design documents and construction administration required to implement the selected improvements.

CWWTP Improvements Project: The overall objective of the CWWTP Improvements project is to provide MWS with regulatory submittals and bidding documents that will allow MWS to comply with the Consent Decree requirements. This consists of improvements to existing wastewater treatment process units throughout the plant including upgrades to the Central Pumping Station (CPS) and the Intermediate Pump Station, improvements to the grit removal system for both CSO and separate system flow trains, replacement of the secondary treatment aeration system, a new UV disinfection

system for secondary plant effluent, a new Peracetic Acid (PAA) disinfection system for the EFTU, and the ancillary system (site/civil, electrical, I&C, structural, architectural, heating, ventilation, and air conditioning (HVAC), plumbing) improvements required to provide a complete and functional system. Based on the current study recommendations and other supporting documentation, the estimate of likely probable construction costs for these improvements will be approximately \$190MM to \$200MM.

In order to facilitate completion of this project, MWS broke the CWWTP Improvements project into two components as summarized below and detailed in Attachment 1:

Component A. New Headworks and Wet Weather Flow Equalization: This element includes 1) coarse and fine screening alternatives for combined sewer flow from the CPS following evaluation of alternatives as outlined in the Project Summary and 2) CSO equalization storage systems to achieve a total volume of 15-20 million gallons (MG) as outlined in the Project Summary. Components of this project element include piping to route flow to the storage tanks and to route drainage flow from the storage tanks back to the CPS.

Component B. Central WWTP Capacity and Facility Improvements: This element consists of improvements to existing wastewater treatment process units throughout the plant including upgrades to the CPS and the Intermediate Pump Station, improvements to the grit removal system for both CSO and separate system flow trains, replacement of the secondary treatment aeration system, a new UV disinfection system for secondary plant effluent, a new PAA disinfection system for the EFTU, and the ancillary system (site/civil, electrical, I&C, structural, architectural, HVAC, and plumbing) improvements required to provide a complete and functional system. Components of the facility improvements also include:

- Demolition design of the necessary facilities.
- Design of recommended flood mitigation improvements for the Central Biosolids Facility and the CWWTP.
- Design of recommended process improvements for the Central Biosolids Facility.
- Design of existing electrical system improvements based on an electrical condition assessment.
- Design of piping improvements based on a piping condition assessment.
- Design of structural modifications based on a structural condition assessment.

Operations support will be provided as part of the upgrades including preparation of a Maintenance of Plant Operations (MOPO) Plan that provides general guidelines and procedures for maintaining plant treatment capability during construction and providing startup, commissioning, and training services.

Accelerated Packages- Accelerated Packages (Aps) will be critical improvements identified in discussions with MWS that will be implemented early in order to improve operations and facilitate CWWTP improvements. In order to fully determine which APs should be included and in what order, a list of potential projects needs to be developed and then evaluated as they relate to the overall CWWTP Improvements Project design, implementation and operations. An upfront task that evaluates this sequencing is part of Phase 1 as described below.

A summary of the phases of the project are described below:



Phase 1 – Evaluation Tasks:

CWWTP Improvements Project (This Scope of Work). Phase 1 includes development of a Basis of Design Report (BODR) for the improvements with recommendations to assist MWS in creation of a project design and construction delivery plan that defines work package options for the selected improvements including: design bid build, construction management at risk (CMAR), MWS internally performed work, or other methods. Based on discussions with MWS, the intent is to procure a CMAR contractor prior to or during Phase 1 of the project. The overall technical scope for this part of the project is described in Attachment 1.

APs Scoping (This Scope of Work). The APs will require an accelerated basis of design process to streamline the implementation schedule for the selected packages such that they can be completed before the main work is commenced. It is assumed that Brown and Caldwell (BC) and MWS will work together to identify the APs that should move forward under an accelerated schedule. Once the APs are identified and specific components defined, this scope document will be amended to reflect the work necessary to complete the APs basis of design. Currently, this scope document reflects the efforts to define the additional scope of work for the APs.

Phase 2 – Detailed Design Tasks:

CWWTP Improvements Project (Scoped during Phase 1). Phase 2 includes development of detailed design packages in accordance with the delivery plan developed in Phase 1. A detailed Scope of Services for detailed design work will be negotiated at the end of Phase 1 after the project delivery methods have been selected.

APs (Scoped during Phase 1). Phase 2 includes development of appropriately detailed design documents for APs. It is expected that design documents and associated effort to complete each will vary due to the different complexity associated with each AP, as well as the different delivery methods that will be employed. These packages will be completed ahead of the main work proposed for this project.

Phase 3 – Construction Administration Services Tasks:

CWWTP Improvements Project (Scoped during Phase 2). Phase 3 includes oversight and support to MWS during construction of the facilities designed in Phase 2. Construction phase services will include but not be limited to administration and representation, submittal management and review, on-site observation, addressing Contractor questions and requests of information, review of contractor pay requests, participation in equipment performance, and start-up testing, etc. as applicable, commensurate with the level of effort required for each project delivery type and package. A detailed Scope of Services for the construction phase services will be negotiated at the end of Phase 2.

APs (Scoped during Phase 2). The Phase 3 level of service for APs will be commensurate with the delivery method used for each AP. The Phase 3 description below provides the framework that a typical project could be implemented. The intent of the APs is that components of Phase 3 will occur in advance of the main work to help facilitate the overall implementation of the project.

Project Coordination and Management Framework

As described above, this project consists of many technically challenging elements that must be evaluated, designed and implemented so that MWS can meet the requirements of the Consent Decree and improve operability and reliability. MWS has reviewed this project and determined that Components A and B as described above will be awarded to two different firms:

1. Component A – Hazen and Sawyer (H&S)
2. Component B – Brown and Caldwell



BC will provide the overall project coordination for the CWWTP Improvements Project and the APs.

Specific coordination activities between BC and H&S have been identified in the tasks below. In general, the coordination will occur in the form of co-participation in technical workshops for elements that overlap Components A and B and other technical collaborations throughout Phase 1.

It is also assumed that some specific coordination will occur with the CWNOAP Program Management Team and Construction Management Team. It has been assumed that this coordination will occur in the form of reviews of selected deliverables and work products, concurrent with MWS staff review.

DETAILED SCOPE OF WORK

The following sections include the detailed scope of work and overall management framework for this initial authorization under the overall contract for the development of the BODR. The scope of work for Phase 1 is based on a twelve (12) month duration. The fee associated with this scope may need to be adjusted if the is schedule delayed.

Phase 001 – Project Management

Objective: To manage, administer, and provide ongoing coordination for efficient utilization of resources for the project. This phase includes technical and financial management of the contract, and administrative coordination.

Approach: Major activities include:

1. Prepare Project Work Plan
2. Prepare kick-off meeting agenda and minutes
3. Attend kick-off meeting
4. Provide documentation of quality control reviews
5. Maintain/update project schedule
6. Maintain/ update risk register
7. Maintain/ update change management and decision making logs
8. Prepare monthly progress reports / invoices
9. Prepare monthly progress meeting agenda and minutes
10. Attend monthly progress meetings
11. Maintain document and project data management database

MWS Responsibilities: It is assumed that MWS will provide the following:

1. Identification and involvement of appropriate MWS staff for participation in monthly progress meetings
2. Timely review of products and decisions on issues critical to scheduled progress
3. Coordinate collection of comments and resolution on issues from MWS and Clean Water Nashville (CWN) program reviewers prior to returning to Consultant

Work Products: Work products that will be developed as part of this phase include:

1. Project Management Plan
2. Project Schedule with Monthly Updates
3. Monthly Progress Reports and Invoices
4. Meeting Minutes from a maximum of 12 progress meetings
5. Project Risk Register (See below for description)



6. Change and Decision logs

Assumptions:

1. Submittal review by MWS is based on two (2) weeks duration.
2. Assume a maximum of 12 months of progress meetings (e.g. 12 progress meetings/reports) and project management for Phase 1 scope.
3. Project management required for each AP is not included in the fee for Phase 1. It will be included as part of the additional services provided based on the scope of work necessary for each AP.

Task 001 Phase 1 Project Management

Task 001 includes project management responsibilities for development of the BODR. APs will require additional definition to fully scope and budget these tasks. Technical and financial management is included to administer and provide ongoing coordination for efficient utilization of resources for the project including the subcontractors.

Task 002 Project Work Plan

Task 002 includes development of a Project Work Plan within thirty (30) calendar days following the receipt of the Notice to Proceed (NTP) for the project. The Project Work Plan will define how the contractual obligations for the Scope of Work will be met and will be used to monitor and control the project's progress. The Project Work Plan will include the following elements:

- Scope of Work describing each major task and associated assumptions
- Schedule with key deliverable milestones in a Gantt-chart format
- Engineering budget with a summary for each task
- Deliverable list including milestone and interim deliverables
- Project Health and Safety Plan
- Project Quality Plan Checklist
- MWS Staff Coordination Plan
- Project Communications Plan
- Site Security Plan (developed as part of Task 007 below)
- Sub-consulting Plan with the following:
 - List of sub-consultants
 - Work to be performed
 - Narrative of how team coordination and monitoring of sub-consultants' work will be accomplished

The Project Work Plan will be prepared for the development of the BODR as part of Phase 1 and will include pertinent components as it relates to the APs.

Task 003 Project Administration and Coordination

Task 004 includes preparation of a Project Communications Plan that clearly defines the administration, coordination, and management responsibilities of the multiple project team members (CWN Program, MWS, Hazen and Sawyer, BC and the CMAR Contractor). The Project Communications Plan will include a proposed chain of communications with procedures for information sharing such as emails, as well as procedures to identify when direct communication can be used to make the work effort more efficient.



Project Coordination

Project coordination is a key element of this project as described above. Due to the complexity of multiple firms working together to develop different elements of the scope and the size of the overall project, it is important that one firm take the lead to deliver one BODR. BC will provide the overall project coordination to bring these the different elements together into one document and deliverable package during Phase 1. Coordination is expected to occur in the form of workshops and the communications plan. In addition, as discussed below BC will setup and maintain a document and project management structure to facilitate this coordination and encourage collaboration.

Task 004 Monthly Progress Reports and Meetings

Task 004 includes the project kick-off meeting, preparation of monthly progress reports and the monthly progress meetings.

BC will conduct a project kickoff meeting along with H&S promptly following NTP to confirm an understanding of project objectives and to develop a road map for completing the project successfully. BC will prepare the meeting agenda and minutes. The kick-off meeting will focus on:

- Establishing and confirming points of contact, method of communication, and documentation
- Discussing and obtaining consensus on the project schedule and work plan
- Defining the project's critical success factors (CSFs) and developing specific means of monitoring and measurement
- Reviewing recommendations and confirming key alternatives to be explored during BODR development
- Discussing the early action projects and potential delivery methods
- Establishing clear expectations relative to project milestones and project deliverables focused on budget, schedule, and quality

A Monthly Progress Report will be prepared and submitted with each month's invoice including the following items:

- Status of design activities performed each month
- Updated change management log and risk register
- Updated schedule and budget status
- Coordination requirements with MWS and other stakeholders
- An invoice of work completed during the month

BC will conduct monthly progress meetings with MWS to review the progress of the project and coordinate operation and maintenance requirements. BC will prepare the meeting agenda and minutes. The meeting will cover the items included in the progress report.

Invoicing and Escalation

In order to effectively manage this project BC will create multiple internal projects within our accounting system. These internal project numbers will be referenced to the overall Purchase Order number for MWS on a summary sheet in the invoice produced by BC. This summary will reference the backup from each internal project number to provide continuity. The BC invoicing template is included as Attachment 2.

In addition, BC will escalate our rates on an annual basis on January 1 starting on January 1, 2017. The escalation rate will be based on MWS procurement guidelines. In addition, at the end of the initial 5-year contract duration, BC will negotiate new rates with MWS to commence at the beginning of year number 6 of the project.



Reallocation of Project Funds

As part of overall management of the budget for this project, BC will work with MWS to reallocate funds as necessary due to changes in scope, schedule, or unforeseen events.

Task 005 Risk Management

Risk Management is an important aspect of managing a project of this size and complexity. There are events or items, which if they occur, can cause cascading consequences to the project, such as increased fee, prolonged schedule, or other impacts. These event will be documented in a risk register along with the potential impacts and potential mitigation measures. Mitigation measures can be as simple as direct management of an element such as implementing early procurement of the CMAR to control overall project costs as the design is being completed. It may include implementing contingency plans for things that could occur but are uncertain.

BC will begin the risk register prior to the project kick-off meeting. This risk register will be updated after the kick-off meeting. BC will continue to update and review it with MWS and the team on a regular basis throughout the project to mitigate the overall impacts to the project.

Task 006 Document and Project Data Management

BC will utilize a document and project data management system similar Buzzsaw or SharePoint to enable project team members to quickly access, view, and share large documents and track project correspondence. The system will be coordinated with the CMAR contractor and evaluated during Phase 1 to identify an efficient system to implement during Phases 2 and 3. This system will allow for project team members to access living documents for editing and review. The CWN Program will use the system to acquire the necessary data and deliverables for the PMIS maintained for the CWN Program.

Task 007 Site Security Plan

BC will create a site security plan that meets the requirements of MWS. This plan will be submitted and reviewed by MWS as part of the Project Work Plan.

Phase 010 – Quality Control

Task 001 Quality Management Plan

Task 001 includes creating a Quality Management Plan that meets the requirements of MWS. This document will outline procedures for both quality assurance (QA) and quality control (QC) to be implemented by the BC team to manage quality throughout Phase 1.

Task 002 BODR Quality Control

QA and QC are two aspects of quality management. QA is the aspect of the quality that occurs during the evaluation and design phases of the work such as calculation checks, etc. QC is the senior checking that occurs at key times during the project. The senior reviewers are independent of day-to-day work on the project. They will review and provide the team with unbiased technical input that the team will be required to respond to as the project progresses.

Task 003 Quality Management Documentation

Task 003 includes documentation that deliverables have been reviewed in accordance with the Project Quality Plan Checklist. Comments generated by the internal quality checking and review processes will be addressed and the deliverables revised accordingly prior to the submittal of design milestone deliverables.

Phase 020 – Design Management

The CWWTP Improvement project will require the collaboration of multiple disciplines spread across multiple firms and offices in order to complete. The design manager is responsible for facilitating this coordination and collaboration to meet the project objectives.

Phase 030 – MWS Operation Coordination

Budget has been included by BC for coordination with operations staff in the field based on an assumed number of hours and total effort. The coordination will allow BC team members to talk in the field with operations staff about the improvements and provide miscellaneous operations support as needed. BC will work with MWS to determine if additional resources are necessary as an allowance if this initial budget is exhausted.

Phase 100 – Basis of Design Report (BODR) Services

Objective: The CWWTP Improvements project requires the development of a BODR that documents the design criteria for elements to be improved during the project and fully designed during Phase 2. The BODR will be a single document referenced for Phase 2 activities. This BODR will also document the findings and recommendations from the workshops and evaluations completed during Phase 1.

Accelerated Basis of Design memoranda will be completed for each AP to provide guidance during the Phase 2 Design for the APs.

Approach: The approach for the CWWTP Improvements Project and APs as part of Phase 1 is presented below.

CWWTP Improvements Project. The BODR will be based on the outcome of document review, field investigation activities, and workshops with MWS staff. During the development of the BODR, BC will coordinate with H&S at specific points, primarily through workshops, in an effort to coordinate on project elements that overlap Components A and B.

BC will have primary responsibility to write the text of the BODR. H&S will write specific technical memoranda (TM) addressing their scope of work (See Attachment 1) which BC will include as appendices to the main BODR text. The BODR will consist of the following elements:

- Results of the evaluations listed in the Project Scope section of the Project Summary per the RFQ requirements
- Listing of recommendations for separate design packages and delivery approach for construction
- Design criteria for each design task items
- Geotechnical findings, analysis, and recommendations
- Information for required additional property acquisition and/or temporary construction easements
- Listing of required permits and associated fees and a milestone schedule that indicates critical permit preparation milestones that fit within the proposed design completion schedule
- Preliminary Opinion of Probable Construction Costs that meets a Class 4 on the Cost Estimate Classification System per the AACE International Recommended Practice No. 56r-08
- Preliminary design and construction schedule
- Preliminary list of CSI Division 1 through 48 specifications
- Preliminary list of drawings
- Preliminary schematic process layouts
- Preliminary process flow schematics and diagrams and hydraulic profiles

- Sustainability Checklist (found in Appendix L of the Design Management Manual)
- Operational plan for execution of the work to stay within compliance and maintain plant operations
- Sequencing plan for implementation of the overall improvements (completed as part of Phase 109 detailed below)
- Risk management plan to facilitate the successful implementation of the optimization
- List of outstanding issues
- Coordination with TDEC

APs. As described above the APs will require accelerated implementation to facilitate the overall project. As such this section provides a framework that can be used for scoping the required activities for each AP once the list of APs is determined. Each AP basis of design memorandum will be written by the lead firm identified by MWS. These memoranda will consist of the following:

- Listing of recommendations for separate design packages and delivery approach for construction
- Design criteria for each design task item
- Listing of required permits and associated fees and a milestone schedule that indicates critical permit preparation milestones that fit within the proposed design completion schedule
- Preliminary Opinion of Probable Construction Costs that meets a Class 4 on the Cost Estimate Classification System per the AACE International Recommended Practice No. 56r-08
- Preliminary design and construction schedule
- Preliminary list of CSI Division 1 through 48 specifications
- Preliminary list of drawings

MWS Responsibilities: It is assumed that MWS will provide the following:

1. Record drawings, permits, operational data, etc. that contain the site existing data and information
2. Access to staff during site visits to corroborate information from the site information and to provide additional understanding of operational concerns.

Work Products: Work products that will be developed as part of this phase include:

1. BODR
2. AP Basis of Design Memoranda (As amended to this scope of work)
3. Updated Risk Register
4. Class 4 Cost Estimates

Assumptions:

1. Facility improvements as part of the BODR will be shown in plan view, equipment located on the site, building footprints established, major structural improvements to existing basins shown in plan view, ancillary equipment locations, etc.
2. Drawings will be 2D CAD or Blue beam PDF drawings for the BODR. Development of BIM/ 3D will be discussed during the BODR and will be coordinated with the CMAR contractor. The fee for Phase 1 BODR is based on utilizing Blue beam PDFs for all record drawings used to depict the facility improvements.
3. CMAR contractor will be part of the pertinent workshops and reviews prior to finalizing the BODR if retained by MWS prior to or during Phase 1 activities.



4. BC will lead the BODR for MWS.
5. Each AP will require an accelerated basis of design memorandum. However, this scope document does not include effort for completing the AP basis of design memoranda. This scope only includes effort to determine the APs and produce a scope of work to complete the required memoranda.
6. BC will not take responsibility or liability for the work provided by H&S. H&S' work will be appended to the documents as provided to BC. A standard template will be provided to the team to follow for each TM completed.

Task 100 Summarize Code Classifications

Task 100 includes development of a comprehensive code classification table per discipline to be included in the BODR.

Task 200 Develop Permitting Plan

Task 200 includes development of the permitting which will include a list of permits and associated fees with schedule requirements and milestones for preparation and submittal of necessary permits.

Task 300 Develop Land Acquisition Plan

Task 300 includes development of the land acquisition plan for improvements designed by BC, if needed.

Task 400 Draft Sustainability Plan

Task 400 includes development of the sustainability plan for the overall facility improvements. This task will be led by BC, and will be coordinated with H&S. The intent is to develop a comprehensive sustainability plan for the CWWTP and Biosolids Facility.

Task 500 Site Investigation Summary and finalization

Task 500 includes summarizing the site investigations for the topographic and structure surveys, and summarizing the sampling plan for the demolition of identified structures pertinent to remediation and potential hazardous materials to be included in the BODR.

Task 600 through 601 Technical Memoranda for Component A Elements

Task 600 through 601 includes completing the technical memoranda for Component A Elements. See Attachment 1 for detailed information. H&S will lead and produce these memoranda. BC will collaborate and provide design concepts review.

Task 700 through 710 Technical Memoranda for Component B Elements

Task 700 through 710 includes completed the technical memoranda for Component B Elements. See Attachment 1 for detailed information. BC will lead and produce these memoranda.

Task 800 Opinion of Probably Cost and Construction Schedule

Task 800 includes the completion of an opinion of probable cost that meets a Class 4 on the Cost Estimate Classification System per the AACE International Recommended Practice No. 56r-08. In addition, during this task the team will complete a preliminary construction schedule of the selected improvements.



Task 900 BODR Documents

Task 900 will develop the BODR documents for the overall facility improvements. BC will incorporate H&S design elements into the BODR by including the H&S project TMs as an appendix and referencing specific technical conclusions in the main body of the BODR document.

Quality Assurance

QA for the CWWTP BODR is provided for each TM and the body of the text. QA includes items such as calculations checks, etc. that are part of the standard BC quality process. The effort for this is contained in the effort to complete each TM and the BODR text.

Phase 101 Data Collection and Field Services

Objective: The objective of this task is to collect the pertinent facility data available as the basis for the design calculations, drawings, and specifications to be completed in Phase 2.

Approach: The data collection and field services are anticipated to include the following activities:

- Collection of plant operating data, plant permits, and/or as-built drawings not included in this Scope of Work but deemed pertinent to design of the improvements
- Surveys of wastewater facilities (structure elevations, weir elevations for hydraulic analysis, visual inspection of existing structures, etc.)
- Surface/roadway/building conflict reviews
- Topographic surveys
- Evaluate where laser scanning would be useful to complete the detailed design during Phase 2. Any locations for laser scanning would be scoped and a fee developed as an additional service.

MWS Responsibilities:

1. Site access for surveyors and laser scanning crew
2. Providing existing system and operational data and record drawings.
3. Provide existing survey information for the CWWTP

Work Products:

1. Existing Data sets in usable format
2. Topographic Survey
3. Scope and fee for laser scanning.

Assumptions:

1. Three days of field work for BC.
2. The majority of the needed data was previously collected by BC during the Central Optimization Study.
3. There are available existing surveys of the CWWTP and Biosolids Facility that can be used for completing a topographic survey.
4. Per the attached fee, BC assumes that the survey can be completed with this allowance and we will work with MWS to develop a surveying plan once existing surveys can be reviewed.
5. Additional scope and fee for laser scanning are not included in this fee and would be additional services.

Phase 102 Subsurface Investigations

Objective: The objective of this task is to collect the needed subsurface information for the Phase 2 designs.

Approach: BC will collect and review available documents and information that may assist in clarifying existing geotechnical conditions, including groundwater levels and detrimental soils conditions likely to be encountered. These documents will include related studies and evaluations, plans and specifications, and other documents deemed pertinent to the project and not included with the information in this Scope of Work. Once this initial geotechnical investigation of the existing work is completed data gaps may be identified that require additional geotechnical investigations to be completed.

MWS Responsibilities:

1. Provided existing geotechnical reports and data for the CWWTP
2. Site access for the geotechnical drilling company (if required)

Work Products:

1. Geotechnical Gaps if any
2. Additional Geotechnical Investigations Scope and Schedule

Assumptions:

1. BC is not anticipating new major structures for Component B improvements. BC is therefore assuming that no additional geotechnical investigations above the existing information will be required. If during the initial evaluation of improvements or during the review of existing geotechnical data that changes additional geotechnical work may be required.
2. Scope and fee for geotechnical investigations for Component B is not included in this fee and would be additional services.

Phase 103 Site/Civil Engineering Services

Objective: The objective of this task is to provide a conceptual design for stormwater, paving, and grading improvements.

Approach: BC will identify the existing local site and floodplain locations for site planning and layout. The following preliminary engineering tasks will be performed and included in the Basis of Design Report:

- Preliminary site grading layout.
- Determination of storm water collection modifications.
- Preliminary pavement design (typical sections based on improvement location).
- Verify inventory of existing facilities to be demolished.
- Provide preliminary determination of locations for surface restorations, surface improvements, Best Management Practices implementation, and seeding and/or sodding.

MWS Responsibilities:

1. MWS will provide construction as-builts for storm water improvements.

Work Products:

1. Preliminary site grading and storm water collection modifications
2. Preliminary paving design



Assumptions:

1. BC will coordinate the site/ civil engineering services for Components B. BC will identify needed stormwater permits for proposed improvements of Component B elements.
2. Delineation of the site/ civil design and permitting will be developed during Phase 2 negotiations.

Phase 104 Technology Site Visits

Objective: Scope for site visit or coordinating conference calls with utilities that have the same equipment or similar configurations to those proposed by the design team. Site visits and/or conference calls allow for MWS and project staff to discuss design, construction, and operational items with these facilities and staff. This information will be used as lessons learned that can be used during this project.

Approach: Assume up to three (3) technology site visits and five (5) teleconferences. Major process areas that will be discussed during these visits are summarized below:

- Coarse Screen/ Rock Trap
- Vortex Grit Removal
- Fine Screen
- Fine Bubble Diffusers
- Aeration Blowers
- Ultraviolet Disinfection

BC will lead technology calls and visits for the Vortex grit system, fine bubble diffusers, blowers, and Ultraviolet disinfection. BC will participate in the remaining technology meetings and calls for the coarse screens, rock trap and fine screens.

MWS Responsibilities: It is assumed that MWS will provide the following:

1. MWS will provide a list of personnel that will participate in the visits and calls.
2. MWS will participate in a preliminary meeting to confirm the visit locations.
3. MWS will coordinate their personnel’s travel arrangements

Work Products: Work products that will be developed as part of this phase include:

1. Meeting minutes for technology visits and conference calls.

Assumptions:

- BC will lead 1 technology site visit and 4 technology teleconferences including preparation of meeting minutes for each.
- BC will participate in 2 technology site visits in support of Component A work
- The trips are based on airplane travel and a maximum of 1 night in a hotel for each trip.
- BC assumes that a maximum of 3 BC personnel will participate in the technology site visit led by BC and a maximum of 2 BC personnel will participate in Component A technology site visits.
- BC assumes that MWS will be responsible for their own travel arrangements and expenses.

Phase 105 Electrical Condition Assessments

Objective: The electrical primary power distribution, control centers and associated gear need to provide reliable and redundant electrical feed to support the goals of the consent decree and reliability goal of the project. The overall objective of the BODR is to provide schematic improvements required to these systems and the associated costs for the improvements.



Approach: BC will perform preliminary design services to evaluate options to provide redundancy and reliability both short and long-term of the CWWTP medium voltage (MV) electrical distribution system. The system modifications required in the CWWTP Improvement project include evaluation of new utility feeds for Biosolids Facility and disinfection system. The January 2015 CWWTP Electrical Assessment Report will be used as the basis for the evaluation.

MWS Responsibilities:

- MWS will work with BC to determine areas and equipment less than 20 years old that should be tested.
- MWS will provide access to the electrical equipment throughout the plant and assist as needed with inspection of electrical gear.
- MWS will provide as-built and other existing data for the electrical equipment to the team.
- MWS will provide historical knowledge of the existing electrical systems pertinent to Operations & Maintenance (O&M) issues.

Work Products:

- Electrical Condition Assessment (as agreed to by MWS)
- BODR Documents for the primary power improvements
- Class 4 cost estimate for primary power improvements

Assumptions:

- The existing preliminary condition assessment report provided in the RFQ will be used as the basis for continues assessment.
- Equipment 20 years and older will be assumed to be replaced during improvements to the associated process area.
- Equipment testing will be coordinated with MWS to determine if it can be de-energized.
- Equipment testing and inspection will be done by personnel trained and experienced in ARC flash hazards, using appropriate protective equipment and procedures.
- Per the attached fee, BC has assumed an allowance to complete the testing and develop BODR documents for the primary power improvements. We will work with MWS to identify feasible scope within this budget to complete this work as part of Phase 1.
- The electrical condition assessment will focus on the equipment inspected and tested. Other conditions may exist that may impact the project that remain undetected during the assessment.

Phase 106 Structural Condition Assessments

Objective: As part of the improvements a structural condition assessment is necessary to determine the required rehabilitation of existing structures to provide reliable service for the Central WWTP.

Approach: BC will perform a structural condition assessment of the existing structures within the scope of improvement that BC is designing to identify a scope of work for necessary rehabilitation.

MWS Responsibilities:

1. MWS will provide access to the team to evaluate the structural elements of the project.
2. MWS will provide as-built and other existing data for the structures.
3. MWS will communicate perceived structural issues.

Work Products:

1. Structural Condition Assessment



Assumptions:

1. No testing will be performed as part of the condition assessment.
2. Visual inspection will be performed.
3. Tank and structure draining will not be performed as part of the assessment outside of any draining that occurs during normal operations or routine maintenance.
4. The structural condition assessment will focus on the structures inspected. Other conditions may exist that may impact the project that remain undetected during the visual assessment.

Phase 107 Critical Piping Assessments

Objective: As part of the improvements in Component B a piping condition assessment is necessary to determine the required rehabilitation of existing piping impacted by the project to provide reliable service for the Central WWTP. An existing piping assessment was completed in the past that can be referenced during this scoping phase to focus the efforts of this work. Due to the complexity of a wastewater treatment plant piping network and the limitations of a piping assessment, it is noted that the assessment will not be able to assess every pipe and find all the issues associated that can impact the plant.

Approach: BC will work with MWS to identify areas of the plant that require assessment based on past assessments and known concerns. BC will then produce a scope and fee based on this information.

MWS Responsibilities:

1. MWS will meet with the team to discuss which locations are of concern.
2. MWS will provide access as needed to finalize the scope.
3. MWS will provide the existing piping assessment report to the team prior to meeting for review.

Work Products:

1. Scope and fee document

Assumptions:

1. This scope document does not include effort for conducting testing or doing the assessment. This scope document contains effort to discuss needed improvements with MWS and determine the scope of effort required to complete the assessment for those improvements.
2. When completed the piping condition assessment will focus on the pipe inspected and tested. Other conditions may exist that may impact the project that remain undetected during the assessment.

Phase 108 Demolition of Existing Structures

Objective: During the planning and construction of structures to be demolished, BC will provide a plan for the necessary investigations to determine a scope of work for decommissioning of specified structures identified in the RFQ and during the initial phases of this project.

Approach: BC will perform a visual survey to identify areas that have potential environmental concerns. The survey will identify probable lead-based paint, asbestos, and PCBs that would need to be remediated during demolition. BC will prepare sampling plans to be included in the BODR.

MWS Responsibilities:

1. MWS will provide access to the plant areas where demolition will occur to allow BC to inspect areas to develop the sampling plans.
2. MWS will work with team to determine items to be demolished during this project.



Work Products:

1. Demolition preliminary scope of work and preliminary demolition drawings.
2. Class 4 cost estimate for demolition and waste disposal

Assumptions:

1. Material sampling will be performed during a later phase of work. This phase includes developing sampling plans to guide the future investigation.
2. BC will only provide a visual inspection of the buildings and structures identified. BC assumes that a total 2 days in the field will be required to complete this inspection.

Phase 109 Sequencing Plan

Objective: In order to complete the CWWTP Improvements project most effectively and implement the appropriate APs a sequencing plan needs to be completed.

Approach: It is anticipated that this effort will be led by BC with input from H&S for Component A work. The team will work together to determine the appropriate sequencing for construction.

Major activities include:

1. Workshop
2. Draft Strategy Report
3. Final Strategy Report

MWS Responsibilities:

1. MWS will participate in an initial workshop to determine appropriate sequencing and identify O&M considerations.
2. MWS will participate in continued discussions around sequencing during the BODR.

Work Products:

1. Sequencing Plan and preliminary sequencing drawings
2. Preliminary construction schedule
3. Preliminary list of long lead items

Assumptions:

1. BC assumes that this workshop will occur at the beginning of the project to facilitate the AP list creation.
2. This plan will be the guiding document for the improvement staging and will be further developed during subsequent phases of the project for detail design and construction.

Phase 110 Workshops

Objective: An initial planning workshop will be held with MWS staff to review recommendations from the CWWTP Optimization study and confirm the project component goals and objectives. This workshop will serve as a means of identifying needs that will be carried forward as APs. In addition to this initial planning workshop up to 20 workshops will be completed as part of the BODR phase. The workshops will occur on a monthly basis in general. Additional workshops may be required depending on the agenda and duration each month. Additional workshops beyond the budget allocated will be additional services.

Approach: Our workshop approach for all phases of the project includes:



- Meetings with plant staff individually and in groups prior to and during development of concepts to gain buy-in
- Conceptual workshops with the representatives of the entire team to go through design components, review layouts, and make decisions in a collaborative manner
- Follow-up workshops to discuss the design with detailed drawings and specifications summarized for ease of understanding
- Discussions of equipment specifications, schedule, and costs for the design elements throughout workshops and meetings
- Final meetings to vet the design gating process and come to a consensus on decisions
- Management team and progress meetings to keep in line with the overall project objectives, such as budget and delivery schedule to meet the technical and performance requirements of the optimization
- Regulatory meetings with TDEC to review the BODR focused on gaining support and approval for the optimization and incorporate comments from the State into the Final BODR
- Following each workshop, a report summarizing the discussion and relevant conclusions or recommendations for further actions will be submitted to the meeting attendees for review and comment.

MWS Responsibilities: It is assumed that MWS will provide the following:

1. Provide access to personnel prior to workshops to meet individually
2. Provide MWS personnel as attendees who can make decisions during the workshops
3. MWS will review and approve meeting notes and decision in the decision log.

Work Products: Work products that will be developed as part of this phase include:

1. Meeting minutes from each workshop
2. Decision logs for decisions made during workshops

Potential Workshops Topics: The following is not a comprehensive list and includes potential topics:

- Brainstorming Workshops for AP Sequencing and Scoping
- Brainstorming Workshops Components A and B
- Accelerated Package Workshops (scope to be negotiated as the APs are identified)
- Sustainability Workshop
- Evaluations Workshops for Components A and B
- Constructability and Operability Workshops
- Evaluations Results Workshop
- Sequencing Workshops
- CMAR Workshops
- Vendor Workshops
- Structural, Electrical and Piping Condition Assessment Workshops
- Flood Mitigation Workshops
- Survey and Geotechnical Workshops
- TDEC BODR Meeting
- Other Permitting Workshops
- BODR Final Workshop

Assumptions:

1. BC assumes that the workshops will be held at the BC offices in Nashville.
2. BC assumes that five BC personnel will attend on average for the Facility Improvements and Component B, and three BC team members will attend on average in support of Component A. Additional fee has been included by BC's sub consultants to attend workshops as necessary.
3. BC assumes that the workshops will be four (4) hours long and will occur back-to-back on the afternoon of one (1) day and the morning of the next day such that the 20 workshops will be grouped on 10 dates (two subsequent days each).
4. A total of 88 hours of workshops are included for Phase 1 for the initial planning workshop and the monthly workshops.
5. Travel rates are based on a fixed workshop schedule that occurs regularly allowing for advanced travel planning.
6. The workshops will be held at the BC office to facilitate conference calls, webex and participation from BC staff as needed to minimize overall attendance.
7. Jim O'Neill will serve as meeting facilitator for consistency for the Facility Improvements and Component B topics.
8. The workshops will be scheduled regularly on a monthly basis to improve efficiency and scheduling.
9. Once the APs are identified and specific components defined, this scope will be amended to reflect the workshops that may be needed in addition to this initial workshop budget.

Phase 111 Design Standards Framework and Implementation Plan

Objective: Provide guidance to team for Phase 2 and 3 with regard to:

- Design Standards
- Design Packaging for Phase 2 and APs
- Risk Mitigation during Phase 2
- Working with CMAR contractor
- The use of 3D CAD, Building Information Modeling (BIM) or other advanced design technologies during Phase 2

Approach: It is anticipated that this effort will be led by BC. Major activities include:

1. Completing a technical memorandum on a design standards framework that outlines selected design standards for Phase 2 including standard specifications, standard details, and standard delivery formats (such as 3D CAD etc.) to facilitate delivering consistent design packages.
2. Completing a technical memorandum on the implementation of selected improvements. This memo will discuss the selected design packages and delivery methods for those packages, and risk mitigation for implementation.
3. Completing a CMAR bridging document that outlines the roles and responsibilities of the design team, the CMAR contractor and MWS.

MWS Responsibilities: It is assumed that MWS will provide the following:

1. MWS will work with BC to identify standards that are applicable to Phase 2.
2. MWS will review and provide comments on the technical memoranda.
3. MWS will allow BC to review and comment on the CMAR bidding documents.

Work Products: Work products that will be developed as part of this phase include:



1. Technical Memorandum: Design Standards Framework
2. Technical Memorandum: Implementation Plan
3. CMAR Bridging Document
4. CMAR bidding document comments

Assumptions:

1. This scope does not include providing MWS with CMAR procurement services.
2. The technical memoranda will be incorporated into the BODR as appendices.

Phase 112 Flood Mitigation Studies

As part of the BODR, the team will take the Flood mitigation study previously completed and evaluate and develop a conceptual design for the flood mitigation measures as noted in Attachment 1. The flood mitigation recommendations and analysis will be used as a basis for the design to develop conceptual designs for the existing flood mitigation recommendations.

Phase 113 Negotiations for Remaining Phase 2 & Phase 3 AP Work.

An initial allocation for starting the APs will be provided to develop the scope for Phase 2 and Phase 3 services for each AP as determined by MWS. An amendment to this scope of work will be provided when the list of APs is finalized and prioritized. The framework of Phase 2 negotiations is provided below.

Phase 114 Negotiations for Phase 2 CWWTP Improvements Project.

Following the completion of the BODR, MWS and BC will coordinate with MWS in development of the scope of work required for Phase 2 for the CWWTP Improvements Project Part B Components. The framework for Phase 2 negotiations is provided below.

Phase 115 Travel.

Travel effort is included per the attached fee and travel rates for BC team members to attend workshops and site visits in Nashville and travel to facilities to review technologies pertinent to the detail design scope of work.

Phase 116 Allowance.

The allowance will be utilized as directed by MWS for miscellaneous tasks not included in this scope and fee for Phase 1. Items that may be included, but not limited to, are the sludge transfer facility improvements, operator training, final clarifier mechanism replacements, primary power upgrades, CPS isolation gate repairs, detail design, construction phase services, schedule extensions, and additional workshop effort as required.

Phase 2 and Phase 3 Scope Framework

Phase 200 – Phase 2 Design Framework

Objective: The overall objective for the Phase 2 design is to provide MWS with regulatory submittal and bidding documents that will allow MWS to comply with the Consent Decree requirements and goals of the facility improvements.

Approach: BC is proposing the following Phase 2 framework for negotiations after the completion of Phase 1 for the CWWTP Improvements project and for each AP. The information provided below is considered general in nature because the Scope of Work will be refined during negotiation of the Phase 2 design services contract.

Design Management. During Phase 1 MWS and the design team will evaluate various design package alternatives for delivering the final components selected during the BODR. These alternatives will be discussed in the Implementation Plan.

The design team will implement the design standards framework outlined in the BODR to facilitate consistent documents and delivery for MWS.

BC will participate in project design reviews for the 30%, 60%, and 90% Design Submittals and constructability and operability reviews with MWS. The meetings' structure for the 30%, 60%, and 90% review period will be as follows:

- On the day of the submittal, Component A will be presented by H&S and BC will present the design of Component B submittal's key aspects in a workshop with MWS. Key discipline leads will attend this workshop to discuss their portion of the work and answer questions as needed.
- One of the outcomes of the workshop will be to schedule discipline, process, or other issue-specific review meetings for the submittal. These meetings will be scheduled as necessary to 1) optimize the time management of the workshop and 2) allow specific design issues to be discussed in detail with appropriate MWS staff. These meetings will be scheduled within a 2-week period following the workshop.
- Design review meeting will be held approximately five (5) weeks after the initial submittal workshop as determined during the review workshop. Key team members, as appropriate for the subject matter, will attend this workshop either in person or by telephone or video conferencing. At this meeting, MWS will discuss the results of MWS' submittal review comments and BC's internal design discipline coordination reviews.

BC will attend up to six (6) meetings with regulatory agencies. BC assumes two of these meetings will be with TDEC. The first meeting will be an informational workshop to update TDEC about the design's progress and to receive TDEC's comments. The second meeting will be a workshop that will serve to clarify technical or administrative issues that BC, H&S, MWS or TDEC has about the project or the construction permit. Other agencies that may require separate meetings include, but are not limited to, Metro Stormwater, Metro Codes, TDEC field office (for erosion and sediment control), and the U.S. Army's Corps of Engineers.

30% Design Submittal (Preliminary Design)

The intent of preliminary design (30% Design) is to continue to develop the Scope of Work items based on the Basis of Design Report and to review comments received on the Basis of Design Report; finalize siting of equipment, tankage, building additions, and major piping; allow for detailed pricing on long lead time or high volume items; and refine the project's design schedule.

BC will provide the following elements as part of the 30% Design Submittal for Component B:

- Updated equipment, building, and site layouts
- Updated process schematics, electrical one-lines, piping and instrumentation diagrams, and appropriate hydraulic information (these will be final draft documents at this time)
- Updated Basis of Design Report (design criteria will be finalized and accepted by MWS)
- Finalized geotechnical findings and recommendations
- Development of process mechanical drawings from the Basis of Design Report such that a complete conceptual picture of the facilities and work items is presented
- Updated list of proposed drawings for disciplines based on the process mechanical drawings. The anticipation is that this is a final list of drawings

- Preliminary architectural recommendations for new structures and upgraded existing structures to integrate with existing site architecture. Preliminary elevations of proposed work will be included.
- A functional description of the supervisory control and data acquisition (SCADA) and instrumentation and controls systems explaining, in lay terms, the monitoring, controlling, tracking, and level of automation to be designed into the project
- Development of discipline drawings commensurate with the level of completeness of the process mechanical drawings. As examples, 1) if the secondary Aeration Basin process configuration is finalized, preliminary structural drawings for this work will be included; 2) if the north screenings and grit building layout is finalized, preliminary HVAC drawings will be included. Conversely, if the process-mechanical design is not developed to the appropriate level, the discipline drawings will not be started. BC intends to minimize re-work of the discipline drawings due to starting the discipline drawings before the process mechanical decisions are of sufficient detail to start the discipline drawings.
- Supporting calculations, manufacturer’s literature, design criteria, outline specifications, manufacturer’s budget quotes, control strategies, power requirements, and weights for major equipment pieces
- Based on the MOPO section in the Basis of Design Report, preparation of a draft MOPO specification
- A Class 3 Opinion of Probable Construction Costs for the proposed Work items in Microsoft Excel® format. This estimate will be classified and completed in accordance to the AAEC recommended Practice No. 56R-08.
- An Opinion of Probable Construction Duration for the proposed Work items
- Collection of additional data identified in the Basis of Design Report and the subsequent comments (survey, geotechnical, water quality, etc.)
- A list of standard and custom details
- Updated Table of Contents for the specifications, including a review of the CWNOAP standard specifications, a list of items requiring deviation from the standards, and supplemental specifications
- Updated easement and additional property acquisition requirements with legal descriptions written for the required parcels
- Updated and finalized list of permits required for the project
- Major utility relocation requirements
- BC will also provide our internal quality management compliance statement as required
- It is anticipated that an informational meeting with TDEC and other regulators/permit issuers will be held, with the 30% documents used as the informational tool
- An updated risk register

60% Design Submittal

The intent of the 60% design deliverable is to provide MWS with documents demonstrating the design elements and progress of the work have been substantially undertaken. BC will prepare 60% design documents, incorporating the concepts accepted by MWS in the BODR and the 30% Design Submittal for the Component B items.

BC will provide the following elements as part of the 60% Design Submittal for Component B:

- Finalized equipment and building layouts



- Site work and piping plans, including sediment and erosion control
- Finalized process schematics, electrical one-line diagrams, piping and instrumentation diagrams, and appropriate hydraulic information
- Process mechanical plans and major piping diagrams developed to approximately 90%
- Preliminary demolition plans. It is anticipated that every structure or facility to be demolished will have some level of design detail provided with this submittal
- Preliminary structural plans and sections for structural improvements
- Architectural plans and elevations for new buildings based on the 30% Design Submittal and comments
- Preliminary HVAC, plumbing, and fire protection plans, schematics, and schedules.
- Preliminary electrical plans and schedules.
- Draft details sheets, on a discipline by discipline basis to the extent that standard details (identification process will be complete at this stage) and custom detailing needs are identified (It is understood that custom detailing may not be shown at this stage, but place holders on the details sheets for future detailing will be identified).
- Finalized functional and control descriptions of the SCADA and instrumentation and controls system
- Updated and finalized supporting calculations, manufacturer’s literature, design criteria, outline specifications, manufacturer’s budget quotes, control strategies, power requirements, and weights for major equipment pieces
- Updated MOPO specification
- Draft specifications including CWNOAP standard and project developed supplemental sections
- Initial plans for utility relocations
- Updated progress on easement and new property acquisition, if required, and assistance to MWS, as necessary, to provide additional information
- Permit application draft documents
- BC will update the Opinion of Probable Construction Costs for the proposed facilities from a Class 3 to a Class 2. This estimate will be classified and completed in accordance to the AAEC recommended Practice No. 56R-08. An analysis will be provided to identify the reasons for increases or decreases to the construction costs. Prior to proceeding to design stage, BC and MWS must agree on changes in costs.
- Updated Opinion of Probable Construction Duration with an explanation of schedule changes that impact the schedule by more than 30 days
- Verification of the constructability of the proposed facilities and incorporation of necessary improvements into the contract documents. Field inspections by BC’s construction and operations specialists will occur under this task.
- A list of major process design-related issues and proposed resolutions
- BC will include its internal quality management compliance statement.
- An updated Risk Register to be discussed with MWS

90% Design Submittal

The intent of the 90% design deliverable is to provide MWS with documents demonstrating that the design elements and progress of the work have been completed. BC will prepare 90% design documents incorporating the 60% design review comments for Component B elements. The 90%

design documents will be complete excluding final comments from MWS and regulatory agencies, if applicable.

BC will provide the following elements as part of the 90% Design Submittal for Component B:

- Finalized Basis of Design Report
- Drawings illustrating the complete complement of facilities included in the project (including demolished, abandoned, rehabilitated, and new work) including dimensions, abbreviations, nomenclature, legends, and notes for disciplines
- Equipment schedules
- Technical specifications, including the MOPO specification section
- Final permit application
- Descriptions and information to help MWS create easement acquisition documents
- BC will update the Opinion of Probable Construction Costs for the proposed facilities from a Class 2 to a Class 1. This estimate will be classified and completed in accordance to the AAEC recommended Practice No. 56R-08. An analysis will be provided to identify the reasons for increases or decreases to the construction costs.
- BC will update the 60% Opinion of Probable Construction Duration for the proposed facilities. An analysis will be provided to identify the reasons for the proposed changes to the duration.
- A list of remaining process design related issues and proposed resolutions
- BC's internal quality management compliance documents
- Updated Risk Register to be discussed with MWS

100% Design Submittal

The intent of the 100% design deliverable is to provide MWS with regulatory submittal and bidding documents that will allow MWS to comply with its Consent Decree requirements. BC will prepare 100% design documents incorporating comments from MWS' review of the 90% design documents for Component B elements. The 100% design documents will be suitable for regulatory agency reviews as well as for bidding the project. The documents will be signed and sealed.

BC will provide the following elements as part of the 100% Design Submittal for Component B:

- Contract Drawings, specifications and reports, complete, signed and sealed, and ready for bidding.
- BC will update the Class 1 Opinion of Probable Construction Costs to include modifications incorporated into the design. This estimate will be classified and completed in accordance to the AAEC recommended Practice No. 56R-08. An analysis will be provided to identify the reasons for increases or decreases to the construction costs. The final Opinion of Probable Construction Costs will be presented in a format similar to the Bid Forms with estimated unit and lump sum costs for each bid item.
- BC will update the 90% Opinion of Probable Construction Duration to include modifications incorporated into the design. An analysis will be provided to identify the reasons for increases or decreases to the construction duration.
- BC's internal quality management compliance statement.
- BC will provide MWS with four (4) hard copies of the signed Contract Documents for TDEC's review and will supply copies for other regulatory reviews as necessary. BC is also responsible for paying the TDEC application/plans review fee and fees from other regulatory reviews.
- Final design Risk Register for discussion with MWS.



MWS Responsibilities: It is assumed that MWS will provide the following:

1. Negotiate with BC during the Phase 1 to finalize the scope
2. Provide an addendum to this scope

Work Products: Work products that will be developed as part of this phase include:

1. 30% Design Package
2. 60% Design Package
3. 90% Design Package
4. 100% Design Package
5. Permitting Documents as required

Assumptions:

1. BC will not take responsibility or liability for the work H&S completes for this project. BC will incorporate the work into the package as provide to BC if required based on the design packages determined during the BODR.

Phase 300 –Construction Administration Framework

Objective: The objective of this phase is to review the implementation of design improvements required to comply with the Consent Decree and other needed permits.

Approach: BC is proposing the following Phase 3 framework for negotiations after the completion of Phase 2 for the CWWTP Improvements project and for each AP. BC will provide the following services for the design packages BC is responsible for completing.

Construction Administration Framework.

Pre-bid Meeting. BC will attend the Pre-bid Meeting and inspection tour of the project site for each construction package. BC will prepare meeting presentation materials, including PowerPoint presentation, supporting graphics, handouts, etc. BC will lead the meeting.

Construction Meetings and Site Visits. BC will attend construction meetings and perform construction site visits for construction packages. BC will prepare meeting presentation materials, including PowerPoint presentations, supporting graphics, handouts, etc. BC will lead the meetings. These meetings and visits will include but not be limited to the following:

1. Construction progress and coordination meetings (anticipated to be a minimum of monthly for the duration of each construction package)
2. Contractor submittal management and review
3. Contractor pay request reviews
4. Responding to Requests for Information
5. On-site observation of construction activities
6. Equipment startup and testing – attendance at major equipment startup and testing. If an entire system is brought online at one time, BC will attend the startup of the system. If equipment is brought on line in phases (CPS pumps started up one at a time or aeration basins brought online one basin at a time, for example), BC will attend each startup.
7. Plant commissioning review
8. Substantial completion inspection and punch list generation
9. Final completion inspection (as many visits as it takes to accept the Work)

10. Contract Document conflict/clarification meetings as issues arise

General Information

Bidding and construction services can vary significantly, depending on the project delivery method. However, it is assumed that the CWWTP Improvements project will be delivered using a CMAR delivery method. The APs may be delivered with other methods which will be determined during Phase 1 for the APs. The information provided below concerning these delivery methods is considered general in nature because the Scope of Work will be refined during negotiation of the Phase 3 construction services contract.

Resident Engineering Services

BC will provide resident engineering services during construction. The detailed scope of this effort is dependent on the construction schedule and delivery method for the various project elements.

Construction Management Services

BC will provide construction management services during construction. The detailed scope of this effort is dependent on the construction schedule and delivery method for the various project elements.

Bidding Support of MWS

BC will represent MWS' interests during the bidding of each project and provide services to the CMAR contractor, who will be administering the bidding of the work that is not being self-performed. BC's input is expected to be solicited for responses to requests for information and clarification. BC may assist with the preparation of draft bid amendments resulting from responses to technical questions received from bidders including the preparation of necessary plan and specification modifications. BC is expected to attend the Pre-bid Meetings to answer questions and assist with the presentation and site visit, if requested by MWS and/or the CMAR contractor.

Advertising

MWS or the CMAR contractor will be responsible for advertising the project, sending the Invitation to Bid to prospective bidders, and making the reports, plans, and specifications electronically available to bidders. BC will provide assistance if requested by MWS and/or the CMAR contractor.

Conformed Construction Documents

BC will prepare conformed Construction Documents that incorporate bid amendment items into the drawings and specifications.

Support Services during Project Construction

BC will support MWS construction oversight efforts during the construction of each project, but because the CMAR contractor may be performing some or each of these services, the level of effort by BC may be less than that required under a design-bid-build contract. BC's input may be solicited in response to requests for information and clarification, shop drawing reviews, Change Orders, and claims. The extent of these services will be defined during contract negotiations for Phase 3.

BC will attend project meetings during the construction period and provide input based on their detailed knowledge of the project.

Preparation of Record Drawings

BC may prepare (depending on whether or not the CMAR contractor chooses to perform this task) record drawings that accurately reflect changes made to the conformed contract documents during the course of construction. BC may use the CMAR contractor redline markups, BC records from our



observations during construction, and substantial completion and final completion inspections to prepare the record drawings.

Control Systems Integration Coordination

MWS has a preferred system integrator for the CWWTP. The system integrator will provide system integration services for CWWTP construction packages. Services will include application programming, screen design for human-machine interfaces, panel fabrication for project SCADA elements, and field verification of system design (point to point testing).

BC will provide design and construction assistance and coordination services as follows:

Design Services

1. Review and provide input on specifications for SCADA hardware, software, and ancillary equipment that is provided by the system integrator.
2. Provide control descriptions and piping and instrumentation diagrams to the system integrator for their review and comment and make adjustments to the documents as necessary.
3. BC will coordinate with H&S to incorporate I&C design requirements with Component A aspects of the work.

Construction Services

1. Review shop drawings associated with the SCADA / integration system for conformance to the contract documents.
2. Witness field, startup, and operational readiness testing, including verification of the point-to-point tests.
3. Assist the system integrator with preparation of a Control Systems Integration Operations and Maintenance Manual and Training Plan.

Start-Up, Commissioning and Training Services

BC will provide startup and commissioning services to assist MWS. This includes confirming the equipment and systems start up and operate in accordance with the contract documents and MWS operational intent. Services will include the following:

1. Review of contractor-submitted startup, commissioning, and training plans. Comments will be returned to the CMAR contractor.
2. Attendance at startup and commissioning of equipment. If there are concerns during testing, BC will immediately inform the MWS representative. It is noted that BC does not have the authority to stop a test unless there is an imminent threat to life or property. The Consultant comments will be provided to MWS, not the CMAR contractor.
3. Preparation of startup and commissioning reports for submittal to MWS
4. Attendance at CMAR contractor-led training sessions, if requested by MWS
5. On-site presence during several wet weather events. BC will document results of the CWWTP's performance during these wet weather events and provide recommendations to MWS for improving wet weather response.

Operation and Maintenance Manual Preparation

MWS is requesting a fully integrated electronic O&M Manual for the CWWTP. BC will lead the effort to create, populate, test, and train MWS staff on the use of the O&M Manual. The O&M Manual will be turned over to MWS upon MWS' acceptance of it. H&S will provide O&M guidance for their portion of the work and BC will incorporate this into the overall O&M manual.

BC will provide the following services:



1. BC will provide a specification for a vendor supplied electronic O&M Manual resulting in a document that provides MWS with an outline of items that will be included in the O&M Manual and the O&M Manual's interactive capabilities. MWS' operations staff will be integral team members in the development of alternatives for the O&M Manual. BC will review the current state of electronic O&M Manuals, including current user platforms applicable to the CWWTP Improvements Project, and a breakdown of the various levels of interactivity that electronic O&M Manuals can achieve. This task will be performed during Phase 2 services, and the recommended work product will be specified in the contract documents of the various design projects.
2. BC will oversee the creation of the electronic O&M Manual and the population of data during Phase 3 Construction Services. BC will create the platform as part of the first construction project and will oversee data population for every construction project. BC will also oversee the data population of CWWTP system that is not being improved and that will remain in operation as is. BC will input data into the model for projects and will oversee MWS staff's input of data for existing equipment that will remain in service.
3. BC will train MWS staff to operate and maintain the O&M Manual once the CWWTP construction projects are completed. The O&M Manual will become the sole property of MWS at the conclusion of the CWWTP Improvements Project, and BC is responsible for training MWS in the use, care, and maintenance of the O&M Manual's database and interactive features.

Punch List and Final Inspection services

BC will attend the substantial completion punch list inspection for every construction project under their responsibility. BC will create a list of punch list items and will submit it to MWS staff for review. BC will submit the final punch list to the CMAR contractor. When the contractor addresses the punch list items and requests final payment, BC will attend the final completion punch list inspection and submit comments to MWS for review.

Attachment 1 – Technical Scope

Phase 1: BODR Technical Scope Descriptions

The following technical descriptions are included for the Basis of Design Report (BODR) development as part of Phase 1 of the Central Wastewater Treatment Plant (CWWTP) Facility Improvements. The technical descriptions are included for each unit process areas. The design responsibilities include each of the associated disciplines to complete the recommended upgrades (site/civil, electrical, I&C, structural, architectural, HVAC, plumbing, odor control) and control system improvements including integration with and upgrades to the supervisory control and data acquisition (SCADA) system.

Deliverables and assumptions are included to define the level of effort required for each unit process. The deliverables for each unit process of the BODR will include:

- Technical descriptions of the improvements
- Scope summary per discipline
- Design Criteria
- Equipment lists
- Preliminary plan views and layouts
- Preliminary Drawings list
- Preliminary specifications list
- Functional control descriptions
- Sustainability checklist
- Preliminary Operational plan
- Coordination issues and risk mitigation.

Details on the technical scope for each unit process are included below delineated by Component A and B.

Overarching Scope Elements:

- A technical memorandum will be completed for each component listed in the Component A and B Sections of this document.
 - Hazen and Sawyer (H&S) will lead, stamp/seal, and produce the technical memoranda for Component A.
 - Brown and Caldwell (BC) will lead, stamp/seal, and produce the technical memoranda for Component B.
- BC will compile the technical memoranda into a BODR report with each memorandum incorporated into a separate appendix. The BODR report will only summarize the results of the memoranda and provide an executive summary.

Overarching Assumptions:

- BC will not be responsible for H&S's work.
- BC will not direct H&S or its team.
- BC will provide design concepts review of technical memoranda (TM) completed by H&S.
- BC will participate in all workshops.
- The Central Optimization (COPT) Study will be used as a basis to begin the BODR evaluates, where applicable.
- The conclusions of the COPT Study will not be revisited except those identified below.



Component A

1. EQ Storage for CSS

A range of 15–20 million gallons (MG) of equalization (EQ) storage has been initially selected by Metro Water Services (MWS) to provide buffering of quickly rising plant influent flows during wet weather events. It is estimated that this would give plant staff approximately 3–4 hours to prepare the CWWTP to accommodate the Central Pump Station (CPS) influent flow increasing from normal values up to 240 million gallons per day (mgd), assuming flow was diverted to EQ storage at a rate of 150 mgd.

One of the necessary evaluations for this portion of the project is locating the new facilities and incorporating it into the existing site and hydraulic grade line. The general area north of the CPS includes significant underground utilities and major process piping. Therefore, construction sequencing of the new facilities will be extremely important, and careful consideration to continuity of service will be paramount.

BODR Requirements for the EQ Storage:

- Define the function and expected performance of the proposed EQ storage, and identify MWS' configuration preferences. Document critical components and develop criteria that will be used to evaluate improvement alternatives.
- Confirm the required EQ volume and determine peak EQ influent flow rate that must be accommodated.
- Evaluate combined sewer overflow (CSO) equalization storage configurations, potential locations and determine the preferred configuration/location (or locations) to achieve the required EQ volume. Evaluations should include:
 - Cost analysis of alternative tank configurations with respect to tank depth and diameter, and alternative foundation systems
 - Configurations for the yard piping, rock trap, coarse screening, and EQ Storage and coordination with the existing plant hydraulics, and site constraints
 - Civil/site design, stormwater permitting, aesthetics, demolition requirements, ease of access, and utility relocation
- Alternatives include but are not limited to:
 - New equalization storage to obtain the required storage volume
 - Pipe routing for flow to the tanks and from the tanks back into the CPS
 - Site evaluation to determine the preferred location (or locations) for storage
 - Converting the currently abandoned old south treatment system tankage to equalization storage
 - Evaluate “sequential” EQ upstream of high rate treatment
 - Pipe routing for flow to the tanks and from the tanks back into the CPS. Use of a two-way pipe will be considered.
 - Add additional new equalization storage to obtain the required balance of storage volume

BC Scope:

- BC will participate in Component A Workshops.
- BC will provide design concepts review for the technical memorandum.

Assumptions

- H&S will lead, produce, and stamp/seal this technical memorandum.
- H&S will review and revise sections relating to this component in the main text of the BODR.



2. Coarse and Fine Screens for Combined Sewer System

One of the issues that will be addressed by this project is at the headworks of the CWWTP and is the presence of large debris in the influent combined sewage flow. Debris management is a challenge in every combined sewer system (CSS) and typically is most critical during the first flush of a large rain event. Effective removal of large debris prior to the South Grit Facility (SGF) is a primary consideration.

It is intended to evaluate and design a selected alternative for new rock traps, coarse screens, and EQ diversion set at an elevation to facilitate gravity flow into the new EQ and also to the SGF to allow the rock traps and coarse screens to be used continuously during both wet weather events and average flow.

The south fine screens require additional scope development to integrate with the equalization storage and coarse screening component of the overall improvements. The initial BODR development as part of Phase 1 needs to determine if the fine screens should be located upstream or downstream of the combined sewer system grit infrastructure. As part of the COPT Study it was recommended to install fine screens in the existing facility downstream of south grit to save money (structure is already there) and because the heavy grit load from the combined sewer system can potentially damage fine screens and cause performance issues. The COPT Study includes installing partial-flow bypass channels/piping around the existing coarse screens upstream of the south grit tanks because they have been blinded (usually by leaves in the fall and initial flushes) resulting in channel overflows. The bypasses would prevent the overflows by routing a portion of the flow around the existing screens. The evaluation needs to consider implications of CSS flushes of debris and grit that could impact the performance of the fine screens.

BODR Requirements for the Coarse and Fine Screens:

- Define the function and expected performance of the proposed rock traps, coarse screens, EQ diversion, and fine screens, identify MWS' configuration preferences. Document critical components, and develop criteria that will be used to evaluate improvement alternatives
- Evaluate location of new structures concurrently with EQ storage location evaluations
- Evaluate the need for constructing rock traps to remove large heavy debris from flow discharged from the CPS
- Evaluation of coarse and fine screening alternatives for flow from the CPS. Alternatives include:
 - Implementing the COPT Study's screening alternative: Constructing a new coarse screening facility (with rock trap and bypass) downstream of the CPS and upstream of the SGF and the future equalization storage tank(s). Install new fine screens downstream of the south grit tanks in existing abandoned coarse screening building
 - Constructing a new coarse screening facility (with rock trap and bypass) downstream of the CPS and upstream of the south grit tanks and the future equalization storage tank(s). Also, replacing the existing coarse screens with fine screens and bypass channels
 - Building a new headworks facility that includes screening and grit removal upstream of primaries an equalization storage

BC Scope:

- BC will participate in Component A Workshops.
- BC will provide design concepts review for this technical memorandum.

Assumptions

- H&S will lead, produce, and stamp/seal this technical memorandum.
- H&S will review and revise sections relating to this component in the main text of the BODR.

Component B

1. Central Pump Station

The scope associated with the CPS includes evaluation of design improvements to increase the CSS pumping capacity to meet the requirements of the Consent Decree.

BODR Requirements for the CPS:

- Evaluation of alternatives to fluidize the coarse well and facilitate self-flushing features
- Development of computational fluid dynamics (CFD) modeling plan for CPS coarse well to identify improvements to keep small grit in suspension for downstream removal. CFD modeling will be completed in Phase 2.
- Evaluation and conceptual design of necessary improvements to pumps, valving, and piping systems to increase the capacity of CPS to meet the Consent Decree. Coordinate pump operations with new coarse screening/ EQ structure
- Evaluation and conceptual design of rehabilitation and/or replacement of all existing wet well isolation gates/actuators with plan for bypass pumping if necessary
- Evaluation and conceptual of design of the addition of a second clamshell to the current clamshell over the CPS wet well. Design necessary improvements based on the results of the evaluation
- Evaluation and conceptual design of ancillary systems to determine whether the existing facilities can support the additional pumping equipment, VFDs, piping, controls, etc.
- Evaluation and conceptual design of potential odor control at the CPS and coordinate with the new coarse screening/ EQ structure
- Evaluation and conceptual design for reliable automatic level control of the CPS pumps during wet weather

BC Scope:

- BC will lead, stamp/seal, and sign the production of this technical memorandum.

2. South Grit Facility

Reconfiguring the existing south grit tanks (aerated grit) as new vortex grit removal systems was used as a basis of design during the COPT Study. The existing aerated grit tanks are undersized for current and future peak flows. Consideration needs to be given to the necessity of implementing grit removal improvements as part of this project. Currently, primary treatment efficiently captures grit and transports it to the sludge transfer facility where it is effectively removed via the DAFTs at the Central Biosolids Facility via bottom sludge dewatering. Sludge transfer well mixing and screening improvements will help keep the grit in suspension until it reaches the DAFTs. In lieu of proceeding with major grit improvements, another alternative would be to focus on improving grit pumping and capture efficiency and reducing the potential for clogging. It is important to evaluate whether major grit improvements should be implemented as part of the initial central upgrades or if deferring these improvements in a phased approach would be most beneficial to MWS.

In the long-term, new vortex type grit removal systems including new concentrating and dewatering equipment were recommended for installation in the existing aerated grit tanks at the SGF with potential new grit tankage to accommodate the peak wet weather flows and the CSS flushes. Preliminary layouts (Headcell) indicate an achievable capacity of only 160 MGD. Flows in excess of 160 MGD up to 240 MGD would require additional tankage, likely utilizing a portion of the area associated with the old south aeration

tanks (ATs) or potentially requires the relocation of plant electrical distribution equipment adjacent to the SGF.

SGF evaluations must be coordinated with coarse and fine screening evaluations associated with the proposed EQ/ Coarse Screening Facility.

BODR Requirements for the South Grit Facility:

- Coordination of coarse and fine screening alternatives for flow from the CPS.
- Evaluation of the existing south grit system.
- Verifying that the vortex type technology is appropriate to maximize grit removal for flow from the combined sewer system and determining the upstream screening requirements to protect grit units.
- Conceptual design of the conversion of the existing aerated South Grit Tanks to a vortex grit removal system including the replacement or modification of grit pumping, dewatering, and compaction equipment, as needed, and consideration of additional grit tankage.
- Evaluation and conceptual design for optimizing the existing coarse bubble diffusers to achieve lower airflow rates and greater energy savings.
- Development of CFD modeling plan. CFD modeling will be completed in Phase 2.

BC Scope:

- BC will lead, stamp/seal, and sign the production of this technical memorandum.

3. North Grit Facility

Recommendations for improvements to the North Grit Facility (NGF) include installing a new fine screening structure upstream of the existing north grit tanks and providing grit improvements to treat the separate sanitary sewer system. The evaluation will include potentially incorporating existing flow meter vaults and evaluation of their existing condition for continued use. The North Fine Screen Facility design needs to take into consideration of screening and debris management at the pump stations (PSs) within the collection system that could minimize debris issues at the wastewater treatment plant (WWTP).

Enhancements to the existing aerated grit system will also be developed to minimize grit issues downstream of the NGF with potential implementation of additional grit capacity. The conversion of the existing north grit tanks to vortex-type systems will be evaluated. Improvements to the existing grit pumping and piping similar to those implemented at the SGF in 2008 will also be evaluated to reduce the potential for clogging.

BODR Requirements for the North Grit Facility:

- Evaluation and conceptual design of mechanical equipment screens, screen bypass, and screenings collection, compaction and disposal equipment
- Evaluation of potential locations for the new screening structures
- Development of conceptual configurations/layouts
- Evaluation of incorporation of flow measurement in consideration of existing flow meter vaults
- Confirmation of screen/compactor size and type
- Evaluation of an enclosed fine screening facility
- Evaluation of building demolition of the existing supply warehouse located near the area where the new screening structure may be located
- Evaluation of routing of the existing forcemains to the new screening and routing of the screened effluent to the existing NGF via the existing forcemains
- Evaluation of odor control



- Verification that vortex type technology is appropriate for the separate system grit characteristics and determination of the upstream screening requirements to protect grit units
- Conceptual design of the conversion of the existing aerated North Grit Tanks to a vortex grit removal system including the replacement or modification of grit pumping, dewatering, and compaction equipment, as needed
- Evaluating the need to modify existing grit pumps, cyclones, or classifiers
- Development of CFD modeling plan. CFD modeling will be completed in Phase 2.

BC Scope:

- BC will lead, stamp/seal, and sign the production of this technical memorandum.

4. North and South Primary Settling Tanks

Recommendations as part of the Central Study based on CFD modeling include installation of canopy baffles and perforated target baffles to improve north and south primary settling tank (PST) performance and maximize treatment capacity by preventing erosion of the sludge blanket due to incoming flow turbulence. Components of the evaluation include confirmation that the baffle configurations used in the model are constructible and if the existing target baffles can be modified to function as perforated target baffles and achieve the performance indicated in the CFD model. New fiberglass unperforated target baffles were installed in the south PSTs recently, and options to modify these baffles will be evaluated.

Provisions for odor control of the South PST launders and effluent channel will be provided odor covers similar to existing North PST odor control covers. The existing biofilter and odor fans will be evaluated to determine available capacity or if they can be modified to accommodate the south PST odor control loading, in addition to other new loads such as the north screening facility, new intermediate screw pumps, etc.

BODR Requirements for the North and South PSTs:

- Evaluation and conceptual design of canopy baffles below the inlet port and the addition of perforated target baffles to the primary settling tanks
- Evaluation and conceptual design of covers over the south primary settling tank effluent launders and effluent channel for the purpose of odor control
- Evaluation and conceptual design of the odor control duct system required to collect the air and move it to the plant odor control system and the design of the fan or biofilter improvements, as required
- Evaluation and conceptual design of the replacement of the north butterfly gates with cutthroat flumes or weir gates
- Evaluation and conceptual design of a passive bypass of PSTs with a fixed weir near the existing 200 gate
- Evaluation and conceptual design for optimizing the existing coarse bubble diffusers to achieve lower airflow rates and greater energy savings

BC Scope:

- BC will lead, stamp/seal, and sign the production of this technical memorandum.

5. Intermediate Pump Station

Goals of the intermediate PS improvements are to rehabilitate the existing screw pumps and add new screw pump capacity with provisions for automatic mode of operations based on level and other reliability improvements to address current operational issues.



BODR Requirements for the Intermediate Pump Station:

- Evaluation and conceptual design of the new intermediate screw pumps to be located immediately west of the existing Intermediate PS with provisions for a mixing chamber from the north and south PST effluent flow and recycle flow from the Biosolids Facility
 - The capacity of the new pumps will be such that the PS will have the firm capacity to match the peak secondary wet weather treatment capacity.
 - Design will include the manufacturer-recommended rehabilitation improvements to the existing intermediate screw pumps and an examination of the existing structures and channels at the pumping station to determine if repairs are required.
- Evaluation and conceptual design of modifications to the existing pumps to increase reliability
- Evaluation of automatic level based controls to provide more consistent operation
- Evaluation of the installation of motion sensors or tachometers on the screw pump shafts to alert the operation staff of pump issues
- Evaluation of the connection of existing North/South Intermediate PS discharge channels to connect the discharge channels of the two existing intermediate PSs
- Evaluation and conceptual design of the removal of the south primary effluent channel Parshall flume and provisions for flow measurement at a separate location

BC Scope:

- BC will lead, stamp/seal, and sign the production of this technical memorandum.

6. Aeration Tanks

Improvements to the Aeration tanks are focused on replacing the existing draft tube aeration system and meeting the process requirements of the Central Study recommendations to improve biological performance and maximize wet weather capacity. Modifications to the blower system will be necessary to achieve the increased operating pressure from the deep Aeration Tanks. Other major improvements include passive influent flow split and aeration tank arrangements to facilitate wet weather treatment, anaerobic selector, and anoxic/aerobic zones for nutrient removal.

BODR Requirements for the Aeration Tanks:

- Evaluation and conceptual design of modifications to the inlets of the eight secondary aeration tanks to achieve even and passive flow-splitting in dry and wet weather via cut throat flumes
- Evaluation and conceptual design of temporary bulkheading/bypassing required for the installation of eight (8) cutthroat flumes with isolation gates
- Evaluation and conceptual design of a new aeration system in the existing aeration tanks via replacement of draft tube aeration system with a fine bubble aeration system
- Evaluation of the layout of the existing aeration tanks to achieve a system that includes an anaerobic selector and anoxic/aerobic zones for future biological nutrient removal
- Evaluation and conceptual design of new blowers and appurtenances for the aeration system
- Evaluation of modifications to waste sludge piping
- Evaluation and conceptual design of modifications required to the existing blower- building floor, equipment pad configuration, and associated electrical system improvements
- Evaluation and conceptual design of the aeration system and channels including baffle walls in the aeration tanks, raising of the effluent channel walls to improve hydraulic capacity, and construction of cut throat flumes for the aeration tank influent

- Evaluation of optimizing existing coarse bubble diffusers in aeration influent channels to achieve lower airflow rates and greater energy savings in the channels
- Evaluation and conceptual design of improvements to the existing MLSS channel slide gate to facilitate system operations and maintenance
- Evaluation and conceptual design of bulkheading/bypassing to facilitate construction

BC Scope:

- BC will lead, stamp/seal, and sign the production of this technical memorandum.

7. Return Activated Sludge System

Based on the optimized wet weather capacity of the secondary treatment system, modifications are necessary to increase the return activated sludge pumping capacity. A new means of redistributing return solids to the ATs is proposed that utilizes a new RAS splitter box. RAS flow from the north and south secondary clarifiers (SCs) will be routed to a RAS splitter box, where the mixed flow will be passively and evenly distributed to the ATs by gravity. This will prevent the migration of solids to the one end (north or south) of the ATs.

A potential enhancement to the return splitter box also includes a classifying selector to minimize the growth of foam causing bacteria.

BODR Requirements for the Return Sludge System:

- Evaluation of the condition of the existing return sludge pumps to determine if they can be used to facilitate proportional return flow control
- Evaluation and conceptual design of upgraded required additional pumping capacity for the return sludge system
- Evaluation and conceptual design of a new splitter box with new piping to equally and passively split return flow to each AT, and route existing return piping forcemains to new splitter box
- Developing conceptual piping configurations for the new return sludge splitter box
- Evaluating provisions for a classifying selector as part of the return splitter box

BC Scope:

- BC will lead, stamp/seal, and sign the production of this technical memorandum.

8. Secondary Clarifiers

The upgrades include design of improvements to all secondary clarifiers and associated channels and piping to maximize hydraulic capacity and increase clarification efficiency.

BODR Requirements for the Secondary Clarifiers:

- Provide physical inspection of all clarifiers and the design improvements recommended in the COPT study for new clarifier mechanisms
- Finalize evaluation of the South SCs hydraulic function to remove existing constrictions based on the COPT study findings. Design new effluent flow metering.
- Evaluation and conceptual design of a curb around the north SC portion of mixed liquor channel, replace butterfly valves with gate or plug valves
- Evaluation and conceptual design of modifications to the plant control system achieve automatic flow splitting to the SCs
- Evaluating gravity draw-off piping for the clarifier return sludge system



BC Scope:

- BC will lead, stamp/seal, and sign the production of this technical memorandum.

9. South Secondary Effluent Conveyance

The effluent conveyance from the South Secondary Clarifiers will be routed to the North Disinfection area to facilitate one disinfection location for the north and south clarifiers. New conveyance piping will be required to accommodate the increased flows.

BODR Requirements for the South Secondary Effluent Conveyance:

- Evaluation and conceptual design of new conveyance piping between the south clarifiers and the new ultraviolet (UV) disinfection facility including modification of individual clarifier effluent pipes to connect to the new conveyance piping or use of filter influent channel and addition of Parshall flume flow measurement in existing filter bays
- Evaluation and conceptual design of a new effluent pipe from tertiary filter structure to existing secondary effluent vault either in the existing pipe chase or within its footprint
- Evaluation and conceptual design of a cast-in-place junction structures for the north and south conveyance lines

BC Scope:

- BC will lead, stamp/seal, and sign the production of this technical memorandum.

10. UV Disinfection Facility

The existing gas feed systems will be demolished and UV will be implemented for disinfection at the North Chlorine Contact area for combined treatment of the north and south secondary effluent flow. Improvements will include retrofitting the existing chlorine contact tanks to accommodate UV, new Parshall flume effluent flow measurement and installation of electrical and control gear.

BODR Requirements for UV Disinfection:

- Evaluation and conceptual design of a new UV disinfection facility and all electrical and associated improvements to disinfect all secondary plant effluent
- Evaluation and conceptual design of a new of Parshall flumes for flow measurement coordinated with the new UV system

BC Scope:

- BC will lead, stamp/seal, and sign the production of this technical memorandum.

11. Excess Flow Treatment

The Excess Flow Treatment Unit (EFTU) is CWWTP's CSO treatment train, and currently consists of primary settling in the south PSTs and gaseous chlorine disinfection. The COPT study recommends converting to peracetic acid (PAA) disinfection and utilizing the old south aeration tanks as part of the EFTU to achieve primary-equivalent treatment of combined sewer influent flows instead of routing south primary effluent to the EFTU. The abandoned old south SC will also be added to the EFTU contact tank to increase the hydraulic retention time. Part of the project includes a pilot test of the EFTU PAA similar to the one MWS has piloted at Nashville's Dry Creek WWTP.

BODR Requirements for the EFTU:

- Evaluation and conceptual design of testing protocols for the disinfection of flows from the EFTU PAA pilot test for the disinfection of flows from the EFTU (the pilot test will be performed by others)



- Technical support of the PAA pilot during implementation
- Developing design criteria for a new PAA facility to disinfect EFTU flows including tankage conversion and all new structures or facilities required for the PAA disinfection system
- Coordination with EQ Storage evaluation to determine the ultimate use of the old south aeration tanks and two empty cells of the old secondary clarifiers as part of the EFTU. Conceptual design of components associated with EFTU.
- Evaluation of the replacement of the existing butterfly gate that throttles flow the excess flow treatment unit with a weir gate or fixed weir to provide a passive bypass to the excess flow treatment unit

BC Scope:

- BC will lead, stamp/seal, and sign the production of this technical memorandum.

12. Biosolids Facility

The scope of work for the BODR is based on the Biosolids Facility Assessment dated October 2014 as part of the Central Study. During the BODR, components of the work will be evaluated to determine an implementation plan and further define the SOW. Note some of the work from this assessment is being completed as part of the Digester Design Build project. Other components of this assessment may be incorporated in other projects as part of the Energy Management Program and the team will evaluate the most effective delivery methods during the BODR phase.

BODR Requirements for the Biosolids Facility:

- Evaluation and conceptual design of a new PS and forcemain to convey centrate/condensate and digester emergency overflow to a dedicated DAFT treatment unit and a new forcemain
- Evaluation of whether the existing potable water main is capable of delivering sufficient condenser water to dryers while still maintaining fire flow pressure, and connection to dryers as a backup to plant effluent
- Evaluation and conceptual design of an addition of a new smaller waste gas flare to digester gas management system and associated systems to minimize the amount of digester gas that is flared
- Evaluation and conceptual design of alternatives for improvements to the Biosolids facility discussed in the COPT study that are not complete
- Evaluation and conceptual design of containment options at the thickened sludge pumps. Install containment structures around pumps, with pit for portable sump pump to empty containment area into adjacent DAFT tank. Provide a canopy at each location to prevent rain water from entering sump.

BC Scope:

- BC will lead, stamp/seal, and sign the production of this technical memorandum.

13. Primary Power Distribution

Building upon the electrical assessment performed by CDM Smith (Jan 2015), further evaluation of the existing primary power distribution and low voltage power system is required. As part of the BODR, improvements and associated costs will be developed for the necessary electrical upgrades. The overall plant improvements will also be incorporated into the electrical scope of work to accommodate the changes in loading.

BODR Requirements for the Primary Power Distribution:

- Based on the results of the existing electrical condition assessment, identify electrical equipment in need of refurbishment or replacement for long-term reliable plant operation as part of the primary power system



- Evaluation of how that equipment fits into the proposed upgrades and the long-term future for the plant
- Determination of the overall scope of primary power distribution improvements related to:
 - Addition of new process equipment
 - Demolition of existing process equipment
 - Refurbishment or replacement of existing electrical distribution equipment
- Evaluation of the need for a new utility feed for Biosolids Facility and UV disinfection, both currently fed from Central WWTP main switchgear
- Evaluation of improvements that need to be implemented as APs to improve near-term CWWTP reliability and facilitate the overall construction sequence
- Evaluation of appropriate level of electrical submetering to be displayed on existing energy dashboard via the plant DCS
- Evaluation of electrical equipment that requires replacement and may contain hazardous substances such as PCB containing cooling oils. Identification of sampling locations that need further investigation prior to Phase 2
- Evaluation of plant electrical loads and development of the recommended primary power distribution improvements
- Coordination with process mechanical improvements to identify opportunities for energy savings

BC Scope:

- BC will lead, stamp/seal, and sign the production of this technical memorandum.

Assumptions

- Equipment 20 years and older will be assumed to require replacement and will not be tested.
- Testing is not currently included as a main scope item but may be completed as directed by MWS as an allowance.

14. Flood Mitigation Improvements

Flood mitigation plans were developed as a result of the May 2010 Flood event (flood of record) to protect both CWWTP and the Biosolids Facility from future flooding up to the new flood protection elevation (mitigation elevation) which is two feet above the flood of record. The mitigation elevation at CWWTP is EL 421.58 and at the Biosolids Facility is EL 421.00. The difference is due to variations in datums at the two locations as used on the record drawings. The flood mitigation recommendations are detailed in the Post-May 2010 Flood Report dated May 2014. The team will review the flood mitigation measures for both facilities to vet the recommendations and discuss implementation and sequencing implications.

BODR Requirements for Flood Mitigation:

- Evaluation and conceptual design of flood mitigation measures at the Biosolids Facility
- Evaluation and conceptual design of flood protective measures for the CWWTP

BC Scope:

- BC will lead, stamp/seal, and sign the production of this technical memorandum.

